for after the lymph is absorbed the contractibility is always found to be restored. How are the muscles thus automatically renovated without food? It seems highly probable that the reparative lymph exudation which follows exercise is produced by the agency of chemical substances generated by muscular contraction, just as the digestive lymph flow is caused by exogenous lymphagogues. Creatin and lactate of ammonium produce the double curve of arterial pressure induced by exercise and rest.

SLEEP.

A large volume of lymph (not less than 20 per cent.) is exuded into the somatic tissues during sleep.

In sleep the arterial pressure falls very low (from 78 to 82 mm. Hg) and the venous pressure rises to a high point (40 to 50 mm. Hg). There is complete physiological vaso-motor relaxation, consequently the veins not only of the somatic, but of the splanchnic area are filled with blood. The splanchnic stasis is shown by the fact that when a weight (a shot bag of 14 lb.) is applied to the abdomen, the arterial pressure is raised at once from 80 to 100 mm. Hg. In a few minutes, however, when the subject is fully awake, the arterial pressure rises to 95 mm. Hg or so, the venous pressure falls to 15 or 20 mm. Hg, the shot bag no longer raises the arterial pressure, and the effused lymph of sleep, having become absorbed, is no longer apparent.

What is nature's intent in thus supplying the tissues so liberally with lymph during our sleeping hours? The answer admits of no doubt—restoration; and how true to fact is the old proverb, "He who sleeps, dines"! For during sleep nature provides the maximum amount of tissue-lymph, which we only obtain intermittently after meals. Can this be proved? The answer is provided by the tension test.

[Dr. Oliver here epitomised the results of a night and morning record, demonstrating in figures the restorative power of sleep.]

[The effects of gases (oxygen, carbonic acid, sulphurous acid, sulphuretted hydrogen, and the atmosphere of sewers), of gravitation, of temperature, and of internal secretion (supra-renal, thyroid) on the tissue-lymph circulation were described, and the vexed question as to whether tissue-lymph is a secretion or a pressure product was discussed.]

Is there an intermediary circulation?—The rapid removal of lymph from the tissues when the muscles are at rest, for example, after exercise and on awaking from sleep, suggests absorption rather than transmission by the lymphatics. Therefore I think there is evidence in support of a circulation of fluid independent of the lymphatic circulation, though controlled by the capillary circulation, of which it may be said to be an extension.

There is not time to discuss the forces involved. The best account of them, as at present known, is that given by Prof. Starling, of University College, than whom no one has done more valuable work in support of Ludwig's pressure theory (Schäfer's "Text-book of Physiology," vol. i.). Ludwig pointed out that the prime factors in the effusion of lymph are filtration and diffusion. My observations refer only to filtration, and they suggest such a scheme of the intermediary circulation as is represented in Fig. 5, which shows the mechanism, as it were, for the supply of pabulum to the tissues (AA) and for the removal of soluble waste from them (BB). The view there represented explains why the ingestion of food restores the tissues at once, and long before the food itself can be assimilated into the blood. The exhausted tissues have not, therefore, to remain unsupplied until the food becomes part of the common store of pabulum, which the blood keeps ready for distribution. Each supply of food may be viewed as a deposit paid to our banking account, but it is not merely a deposit, for nature combines with it a cheque for payment; the banker therefore is compelled to reimburse at the same time that he receives, so that the balance is kept fairly uniform.

In normal subjects each effusion of tissue-lymph is intermittent, rising out of and subsiding into an apparently lymph-free state of the tissues when the capillary blood-pressure (as indicated by the venous pressure) touches its minimum point. Probably at such times some trace of tissue fluid is actually present, but insufficient to be made apparent by the ordinary use of the differential test.

[Some practical deductions were here drawn, and new remedies suggested by the inquiry were described.]

There is much more work to be done, but meanwhile let me summarise a few provisional conclusions :—

(1) Tissue-lymph is intermittently effused, for example, after the ingestion of food, during exercise, rest after exercise, and during sleep.

(2) The rapid effusion and removal of it in states of rest suggest the existence of a circulation between the blood and the tissue spaces—a circulation independent of the lymphatic circulation.

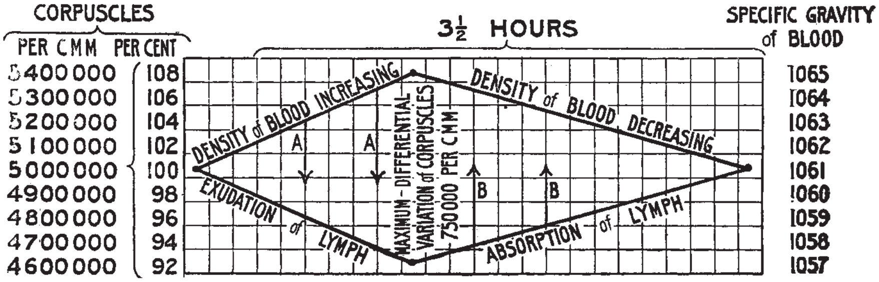

FIG. 5.—Schema showing (AA) exudation of lymph conveying proteids and salts to the tissues and (BB) absorption of tissue fluid containing soluble waste and salts.

(3) The apparent physiological intent of the effusion is reparative, and that of its absorption to aid the removal of tissue waste.

(4) By studying the conditions which increase or decrease lymph effusion, we ought to gain a clearer insight as to how to control derangements of nutrition and metabolism.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

MR. HUBERT M. TURNBULL, Magdalen College, Oxford, has been elected to a Radcliffe travelling fellowship for three years.

THE Rede lecture at Cambridge will be delivered on June 11 by Dr. J. A. Ewing, F.R.S., upon "The Structure of Metals."

DR. F. G. DONNAN, lecturer in chemistry in the Royal College of Science, Dublin, has been elected to the chair of physical chemistry recently founded by Sir John T. Brunner in the University of Liverpool.

THE *British Medical Journal* states that the new medical laboratory of the University of Pennsylvania is to be opened on June 30. Exclusive of site and equipment, the building has cost nearly 140,000*l*. It is the first of a group of buildings it is proposed to erect, which when completed will, it is hoped, form the largest system of buildings devoted to the teaching of medicine in the world.

As a general result of the various movements in recent years to establish a centre of veterinary education in Liverpool, it has been arranged, we learn from the *Times*, that Prof. Williams, of the New Veterinary College, Edinburgh, shall transfer his teaching centre to Liverpool and take up the professorship of veterinary medicine and surgery offered by the Institute of Comparative Pathology, and shall act as principal or dean of the veterinary school. Prof. Williams will be placed upon the same footing as professors in the university, and the cost of the professorship has been privately guaranteed for a period of years. In accordance with a scheme drawn up five years ago by

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the professors of pathology, physiology, zoology, and botany, veterinary students will be taught in their respective laboratories, and will enjoy, without increase of fees, all the facilities possessed by medical and science students. They will, in addition, have the advantage of the Tropical Medicine, Cancer Research, and Comparative Pathology Schools. This arrangement will provide for the scientific training of the veterinary student upon a scale equal to that of the medical student.

AT the concluding meeting of the session 1903–4 of the Architectural Association, Mr. A. E. Munby read a paper on the value of science in an architectural curriculum, in which he urged that science should receive more attention from architectural students. He mentioned some interesting particulars as to the number of hours per week devoted to science by students studying in architectural courses in the great technical schools of the world. To give a few examples, Mr. Munby stated that the architectural student at McGill University devotes 7·9 hours a week to science classes; at University College, London, 6·8; at Glasgow Technical College, 5·3; at the University of Illinois, 4·9; and at the Technischen Hochschule, 2·5. To conclude his paper, Mr. Munby made suggestions as to the subjects of science an architectural student should study at the outset of his career. These should include, he thought, a general experimental course on physics, including laboratory work; a similar course dealing with the elements of inorganic chemistry; and a short course outlining the principles of geology and dealing with the stratigraphical arrangement of rocks and with petrology. The whole of this work might be undertaken by a person of average intelligence at the age of, say, sixteen, and completed in one year with some twelve hours' teaching per week.

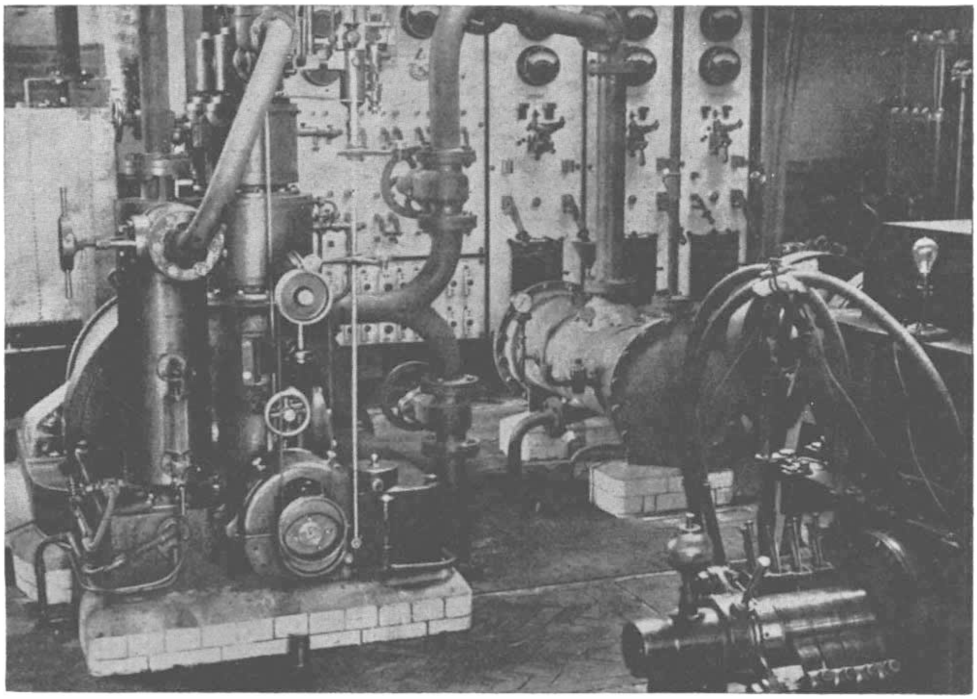

FIG 1.—Main Lighting Plant of the South-Western Polytechnic.

IN connection with the recent opening of the new buildings, extending the South-Western Polytechnic at Chelsea, the heads of the electrical and mechanical engineering departments have prepared a pamphlet describing the aims and equipments of their respective laboratories. In these laboratories two classes of students receive instruction, viz. those who attend the engineering day courses and those who form the evening classes. The standard of the courses extends far enough to include preparation for the engineering degree of the University of London, and attention is given to the requirements of candidates for the associate membership of the Institution of Civil Engineers. But no particular syllabus is followed, and students are able easily, if necessary, to take other public examinations in engineering. So far as funds have permitted, an attempt has been made to provide in the mechanical engineering laboratory more than one type of some pieces of apparatus, in the belief that the range of experience thus gained by a student is of value, while such a variety enables a number of students to be less thickly distributed over the apparatus. Many of the larger pieces of apparatus have not been specially designed for experimental purposes, but are ordinary standard commercial machines which have been fitted with the necessary measuring appliances by students and the workshop instructor. The electrical engineering laboratories are divided into three principal rooms—the large laboratory where the testing of electrical instruments and the measurement of electrical quantities are carried out; the dynamo room where the experiments and investigations on dynamos and motors are conducted, and the "advanced" laboratory where the standard instruments are kept and used for calibrating the instruments used in experimental work, and where the more advanced alternating and polyphase current experiments are made. In addition to these rooms, there are two rooms fitted up for photometric tests on incandescent and arc lamps respectively. There is also a large wiring shop for instruction in practical wiring and jointing, and two workshops for repairing and making apparatus for the electrical laboratories. There are in all six steam engines specially fitted up for experimental work. Recently, when the electric lighting plant had to be duplicated, advantage was taken of the opportunity for fitting the new engines with measuring appliances, so that experiments could be carried out on them whenever desired. The plant available permits of the setting aside of either of the new engines for experiment, or the unit experimented upon can be made to provide electrical energy for lighting the building (Fig. 1). The pamphlet contains a full description, with illustrations, of all the more important pieces of apparatus in both departments of engineering.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 28.—"The Effects of Changes of Temperature on the Modulus of Torsional Rigidity of Metal Wires." By Dr. Frank **Horton.**

An account of some experiments performed at the Cavendish Laboratory with the view of ascertaining as accurately as possible the manner in which the modulus of torsional rigidity varies with the temperature. The metals experimented on were copper, iron, platinum, gold, silver,

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